

What is claimed is:

1. An apparatus for facilitating the recording of data, comprising:

an optical source;

5 a metallic structure that receives optical radiation from the optical source and emits optical output from an emission region in said structure, said structure having an array of features that couple the radiation to at least one surface plasmon mode of said structure to increase the emitted optical output from said emission region beyond what the emitted optical output from said emission region would be in the absence of said features, wherein the emitted optical output  
10 includes a near-field portion that extends from said emission region out to a distance less than the average wavelength of the emitted optical output; and

at least one element secured to said metallic structure, said at least one element generating magnetic fields for writing data in a data recording medium located within the near-field portion.

2. The apparatus of Claim 1, further comprising a platform to which said structure and  
15 said at least one element are secured, wherein said platform is configured to be moved relative to a data recording medium while the separation between said emission region and a surface of the data recording medium is kept to less than said average wavelength.

3. The apparatus of Claim 2, wherein said separation is no greater than said near-field distance.

20 4. The apparatus of Claim 2, wherein said platform is a slider having an air-bearing surface.

5. The apparatus of Claim 1, said optical source comprising a laser.

6. The apparatus of Claim 5, wherein said emission region is located at an output face of said laser.

7. The apparatus of Claim 1, said optical source comprising an optical waveguide coupled to a source of optical radiation.

8. The apparatus of Claim 1, wherein said metal structure includes metal selected from the group consisting of Au, Ag, Cu, Al, and Cr.

5 9. The apparatus of Claim 1, wherein said emission region includes dielectric material.

10. The apparatus of Claim 1, wherein the spacing between said features in said metal structure is chosen to enhance the optical output from said emission region from at least one predetermined wavelength.

10 11. The apparatus of Claim 1, wherein said array includes recessed areas within said metal structure.

12. The apparatus of Claim 1, wherein the spacing between said features in said metal structure is periodic.

13. The apparatus of Claim 1, wherein said metal structure is joined to at least one dielectric layer.

15 14. The apparatus of Claim 1, wherein said emission region includes an aperture.

15. The apparatus of Claim 11, wherein said aperture is a slit.

16. The apparatus of Claim 11, wherein said aperture has a width at its narrowest point of about 10-100 nanometers.

20 17. The apparatus of Claim 1, wherein said emission region includes a protrusion member.

18. The apparatus of Claim 1, said at least one element comprising at least one poling piece for applying a magnetic field in a portion of a storage medium as the emitted optical output from said emission region heats the portion.

19. The apparatus of Claim 1, wherein the thickness of said structure is between 50-500 nanometers.

20. The apparatus of Claim 1, wherein the optical radiation from said source has a full width half maximum (FWHM) of less than about 0.1 times the average wavelength of the optical  
5 radiation.

21. The apparatus of Claim 1, wherein the optical radiation has a wavelength that matches a resonant frequency of said structure.

22. The apparatus of Claim 1, wherein said structure includes two features.

23. A method of directing electromagnetic radiation onto a data recording medium,  
10 comprising:

providing a metal structure having an array of features;

directing optical radiation onto the array of features to generate at least one surface plasmon mode, thereby enhancing the optical output emanating from an emission region in the metal structure; and

15 directing the optical output from the emission region onto a recording medium to facilitate the recording of data that is read back by a processor.

24. The method of Claim 23, further comprising applying a magnetic field to the recording medium to write data into the recording medium.

25. The method of Claim 24, comprising heating the recording medium with the optical  
20 output.

26. The method of Claim 25, wherein the spacing between the features is chosen to enhance, at a predetermined wavelength, the optical output emanating from the emission region.

27. The method of Claim 25, wherein the recording medium is granular and has a grain size on the order of between 10 and 250 cubic nanometers.

28. The method of Claim 23, wherein the recording medium includes a medium selected from the group consisting of magneto-optic, phase-change, and chemical change media.

5 29. A method of directing electromagnetic radiation onto a recording medium, comprising:

providing a metal structure having an array of features;

directing optical radiation onto the array of features to generate at least one surface plasmon mode, said at least one surface plasmon mode enhancing the effective transmission of  
10 the optical radiation through the metal structure;

directing optical output emanating from the metal structure onto a recording medium to heat the recording medium, thereby facilitating the recording of data; and

reading back the data with a processor.

30. The method of Claim 29, wherein the transmission of the optical radiation through  
15 the metal structure is resonantly enhanced at a predetermined wavelength.

31. An apparatus for facilitating the recording of data, comprising:

an optical source;

a metallic structure that receives optical radiation from said source and emits optical output from an emission region in said structure, said structure having an array of features that  
20 couple the radiation from one side of said structure to another side of said structure to increase the emitted optical output from said emission region beyond what the emitted optical output from said emission region would be in the absence of said features, wherein the emitted optical output

includes a near-field portion that extends from said emission region out to a distance less than the average wavelength of the emitted optical output;

at least one element secured to said metallic structure, said at least one element generating magnetic fields for writing data in a data recording medium located within the near-field portion;

5 and

a platform to which said structure is secured, wherein said platform is configured to be moved relative to a data recording medium while the separation between said emission region and a surface of the data recording medium is kept to less than said average wavelength.

32. A method of directing optical radiation onto a recording medium, comprising:

10 providing a metal structure having an emission region and an array of features that enhance optical transmission through the emission region;

directing optical radiation onto the array of features;

directing the optical output from the emission region onto a recording medium to facilitate the recording of data; and

15 reading the recorded data with a processor.

33. A method of writing data, comprising:

directing optical radiation onto a magnetic medium to heat a portion of the medium; and

applying a magnetic field to the recording medium to write data into the recording medium, wherein the recording medium has a grain size on the order of 10 to 500 cubic

20 nanometers.